

What is claimed is:

1. A disk array device comprising plural clusters,
wherein the respective clusters comprises:

channel adapters which control exchange of data with host
apparatuses;

disk adapters which control exchange of data with storage
devices;

cache memory packages which are mounted with cache
memories;

basic control memory packages which are mounted with basic
control memories storing control information concerning a
device configuration and a device operation; and

expanded control memory packages which are mounted with
expanded control memories storing directory information
concerning a storage structure of the cache memories, and

the management information is multiplexed by the
respective basic control memories of the respective clusters
and stored.

2. A disk array device comprising:

channel adapters which control exchange of data with host
apparatuses;

disk adapters which control exchange of data with storage
devices;

cache memory packages which are used by the channel
adapters and the disk adapters and have cache memories storing

data; and

plural control memory packages which are used by the channel adapters and the disk adapters and have control memories storing control information,

wherein the control information includes first control information and second control information,

the first control information is stored in different control memories, respectively, and multiplexed, and

the second control information is stored in a separate control memory different from the respective control memories storing the first control information.

3. A disk array device according to claim 2,

wherein the first control information is management information which is used for controlling an operation of the disk array device, and

the second control information is storage structure information concerning a storage structure of the cache memories.

4. A disk array device according to claim 2, further comprising:

a maintenance control unit which, in the case in which a failure has occurred in any one of the plural control memories, restores information stored in the control memory in which the failure has occurred,

wherein the maintenance control unit restores the

information stored in the control memory, in which the failure has occurred, using a storage area of the control memory storing the first control information.

5. A disk array device according to claim 4,

wherein, in the case in which a failure has occurred in the control memory storing the second control information, the maintenance control unit restores the second control information by an amount which can be reestablished in a free space of the control memory storing the first control information.

6. A disk array device according to claim 5,

wherein the maintenance control unit restores the information stored in the control memory, in which the failure has occurred, such that a storage structure of the control memory, in which the failure has occurred, is different before and after the occurrence of the failure.

7. A disk array according to claim 4,

wherein the maintenance control unit executes at least one of (1) a first maintenance mode which is executable in the case in which no usable free space exists in the control memory storing the first control information, (2) a second maintenance mode which is executable in the case in which a usable free space exists a predetermined value or more in the control memory storing the first control information, and (3) a third maintenance mode which is executable in the case in which a

usable free space exists less than the predetermined value in the control memory storing the first control information, and

(1) the first maintenance mode is a mode for,

(1-1) in the case in which a failure has occurred in the control memory storing the first control information, if the control memory, in which the failure has occurred, has been replaced with a normal product, restoring the first control information by copying the first control information multiplexed in the other control memories to the replaced control memory, and

(1-2) in the case in which a failure has occurred in the control memory storing the second control information, reestablishing the second control information overwriting the second control information on the control memory storing the first control information and,

if the control memory, in which the failure has occurred, has been replaced with a normal product, reestablishing the second control information in the replaced control memory, and

restoring the first control information by copying the first control information multiplexed in the other control memories to the control memory on which the second control information has been overwritten,

(2) the second maintenance mode is a mode for,

(2-1) in the case in which a failure has occurred in the control memory storing the first control information, if the

control memory, in which the failure has occurred, has been replaced with a normal product, restoring the first control information by copying the first control information multiplexed in the other control memories to the replaced control memory, and

(2-2) in the case in which a failure has occurred in the control memory storing the second control information, reestablishing the second control information in a free space of the control memory storing the first control information, and permitting replacement of the control memory, in which the failure has occurred, with a normal product, and

(3) the third maintenance mode is a mode for,

(3-1) in the case in which a failure has occurred in the control memory storing the first control information, if the control memory, in which the failure has occurred, has been replaced with a normal product, restoring the first control information by copying the first control information multiplexed in the other control memories to the replaced control memory, and

(3-2) in the case in which a failure has occurred in the control memory storing the second control information, partly reestablishing the second control information by a range which can be reestablished in a free space of the control memory storing the first control information and,

if the control memory, in which the failure has occurred,

has been replaced with a normal product, reestablishing a remaining part, which is not reestablished, of the second control information in the replaced control memory.

8. A disk array device according to claim 7,

wherein the maintenance control unit maintains a storage structure of a control memory related to information restoration work as it is and, in the case in which the second maintenance mode is executed,

(2-1A) if a failure has occurred in the control memory storing the first control information, reestablishing the second control information in the replaced control memory and,

if the control memory, in which the failure has occurred, has been replaced with a normal product, restoring the first control information by copying the first control information multiplexed in the other control memories to the replaced control memory, and

(2-2A) if a failure has occurred in the replaced control memory, permitting replacement with a normal product.

9. A disk array device according to claim 7,

wherein the maintenance control unit maintains a storage structure of a control memory related to information restoration work as it is and, in the case in which the third maintenance mode is executed,

(3-1A) if a failure has occurred in the control memory storing the first control information, reestablishing the

second control information in the replaced control memory and,
if the control memory, in which the failure has occurred,
has been replaced with a normal product, restoring the first
control information by copying the first control information
multiplexed in the other control memories to the replaced control
memory, and

(3-2A) if a failure has occurred in the replaced control
memory, permitting replacement with a normal product and, if
the control memory has been replaced with a normal product,
reestablishing the remaining part of the second control
information in the replaced control memory.

10. A disk array device according to claim 7 or 9,
wherein, in the case in which the third maintenance mode
is executed, the maintenance control unit limits a used area
of the cache memories to a range which is manageable by the
second control information which is partly reestablished in
a free space of the control memory storing the first control
information.

11. A maintenance method for a disk array device
comprising: channel adapters which control exchange of data
with host apparatuses; device adapters which control exchange
of data with storage devices; plural cache memories which are
used by the channel adapters and the disk adapters and store
data, respectively; plural first control memories which are
used by the channel adapters and the disk adapters and store

management information concerning a device configuration and a device operation, respectively; and plural second control memories which are used by the channel adapters and the disk adapters and store storage structure information concerning a storage structure of the respective cache memories, respectively,

wherein the management information is stored in the respective first control memories and multiplexed,

the maintenance method comprising:

a failure detection step of detecting whether or not a failure has occurred in any one of the first control memories and the second control memories; and

a maintenance step of, in the case in which a failure is detected, restoring information stored in the control memory, in which the failure has occurred, using storage areas of the first control memories.

12. A maintenance method for a disk array device according to claim 11,

wherein the maintenance step exclusively executes one of (1) a first maintenance mode which is executable in the case in which no usable free space exists in the first control memory, (2) a second maintenance mode which is executable in the case in which a usable free space exists a predetermined value or more in the first control memory, and (3) a third maintenance mode which is executable in the case in which a usable free

space exists less than the predetermined value in the first control memory, and

(1) the first maintenance mode comprises the steps of:

(1-1) in the case in which a failure has occurred in the first control memory, if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first control memories to the replaced first control memory, and

(1-2) in the case in which a failure has occurred in the second control memory, reestablishing the storage structure information overwriting the second control information on the first control memory and,

if the second control memory, in which the failure has occurred, has been replaced with a normal product, reestablishing the storage structure information in the replaced second control memory, and

copying the management information multiplexed in the other first control memories to the first control memory on which the storage structure information has been overwritten,

(2) the second maintenance mode comprises the steps of:

(2-1) in the case in which a failure has occurred in the first control memory, if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other

first control memories to the replaced first control memory,
and

(2-2) in the case in which a failure has occurred in the second control memory, reestablishing the storage structure information in a free space of the first control memory, and permitting replacement of the second control memory, in which the failure has occurred, with a normal product, and

(3) the third maintenance mode comprises the steps of;

(3-1) in the case in which a failure has occurred in the first control memory, if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first control memories to the replaced first control memory, and

(3-2) in the case in which a failure has occurred in the second control memory, partly reestablishing the storage structure information by a range which can be reestablished in a free space of the first control memory, and,

if the second control memory, in which the failure has occurred, has been replaced with a normal product, reestablishing a remaining part, which is not reestablished, of the storage structure information in the replaced second control memory.

13. A maintenance method for a disk array device according to claim 12,

wherein the maintenance step further comprises, in the case in which the second maintenance mode is executed;

(2-1A) if a failure has occurred in the first control memory, reestablishing the storage structure information in the replaced second control memory and,

if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first control memories to the replaced first control memory, and

(2-2A) if a failure has occurred in the replaced second control memory, permitting replacement with a normal product.

14. A maintenance method for a disk array device according to claim 12,

wherein the maintenance step further comprises, in the case in which the third maintenance mode is executed;

(3-1A) if a failure has occurred in the first control memory, reestablishing the storage structure information in the replaced second control memory and,

if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first control memories to the replaced first control memory, and

(3-2A) if a failure has occurred in the replaced control memory, permitting replacement with a normal product and,

if the second control memory has been replaced with a

normal product, reestablishing the remaining part of the storage structure information in the replaced second control memory.